

# Comparison of the Patient's Postoperative Sore Throat With General Anesthesia on the Use of Lidocaine Nebulizer and Ketamine Nebulizer in Haji Adam Malik Hospital Medan

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## Abstract:-

### ➤ Introduction:

Post operative sore throat and hoarseness are the most common complication of endotracheal intubation due to airway mucosal trauma.

### ➤ Objective:

This study aimed to study the comparison between the use of nebulizer and Ketamine nebulizer in the assessment of post operative sore throat after general anesthesia at Haji Adam Malik Hospital, Medan.

### ➤ Method:

This study is a double blind randomized clinical trial. The research was carried out at Haji Adam Malik General Hospital (RSUP HAM), Medan for 2 months, from April to May 2019. The study samples that met the inclusion and exclusion criteria were divided into 2 groups. Group A received Lidocaine nebulizer, and group B received Ketamine nebulizer. Both groups received the nebulizer to get the target value of lower sore throat. Assessment of sore throat was done 4 times using a VAS.

### ➤ Results:

From the results obtained by VAS, sore throat with general anesthesia in group given Ketamine, was more at VAS 2 value, that amount 16 patients (87.5%), whereas in the group given Lidocaine was more at VAS 3 (45.8%). Statistically, there were a significant difference post operative sore throat patients with general anesthesia in the use of Lidocaine nebulizer and Ketamine nebulizer at T3 monitoring with a value of  $p=0.009$  ( $<0.05$ ). Statistic of post operative sore throat patients with general anesthesia in the use of Lidocaine nebulizer and Ketamine nebulizer at T4 monitoring with a value of  $p=0.033$  ( $<0.05$ ).

### ➤ Conclusion:

There were significant difference in patient with post operative sore throat with general anesthesia in the use of Lidocaine nebulizer and Ketamine nebulizer at 1 hour observation (T1), 6 hours (T2), 12 hours (T3), 24 hours (T4).

**Keywords:-** Sore Throat, Visual Analog Scale, Lidocaine Nebulizer, Ketamine Nebulizer.

## I. INTRODUCTION

Postoperative sore throat and hoarseness are the most common complication of endotracheal intubation due to airway mucosal trauma. This complication can cause discomfort and increase morbidity. This complication causes pain that is difficult to control even though the pain of surgery is well controlled. This complication has not been completely prevented and the best treatments are still sought. (Wei JL, 2012)

The incidence of sore throat and hoarseness due to endotracheal intubation ranges from 5.7 - 90%. It is said that 14.4 - 50% of complaints of sore throat and hoarseness occurred immediately in the postoperative period. From the data collected by the American Society of Anesthesiology (ASA), from professional insurance companies it was found that the most common airway mucosal trauma was in the larynx (33%), pharynx (19%) and esophagus (18%). Patients who experience sore throat and hoarseness will recover within 72 hours. Sore throat and hoarseness can occur alone or together. (Cepeda MS, 2010)

Current evidence until October 2013 included 19 randomized controlled trials (1940 participants) in this latest review. We retraced the search in February 2015 and found four interesting studies. (We will discuss the study when we update the next review.) When the lidocaine is inserted into the caffer, sprayed onto vocal cords, or used as a gel applied to the tip of the tube. There is a significant reduction of postoperative sore throat obtained. (Tanaka Y, 2015).

Administration of intravenous and topical lidocaine has been used to reduce the stimulus of the nucleus during endotracheal intubation. Topical lidocaine or spray-on PET is used to reduce the incidence of post-intubation sore throat, but special tools are needed for this purpose. To lubricate the endotracheal tube, large doses of lidocaine are used which reach 100-250 mg using either spray, ointment, gel or jelly to achieve a plasma concentration of 1.5 µg/ml. For the administration of intravenous lidocaine, the recommended dose is 1.5 mg/kilogram of body weight to

achieve a plasma concentration of 2 µg/ml. Some of these methods have weaknesses, the duration of action is limited after the application of lidocaine because it is rapidly absorbed by the tracheobronchial mucosa and is ineffective in the extubation period. (Gilles Dollo, dkk. 2011).

Ketamine is one of the most frequent intravenous anesthetic drugs that has long been used in the field of anesthesia. According to I Nyoman Adnyana, recent experimental data showed that ketamine with N-Methyl-D-aspartate (NMDA) receptors is present in the Central Nervous System and in the Peripheral Nerves, so peripheral administration of NMDA receptor antagonists such as ketamine has an analgesic and anti-inflammatory effect. Ketamine is an anesthetic drug that is easily obtained in the operating room with a relatively cheap price compared to other drugs. With the potential for analgesics and anti-inflammation the administration of ketamine gargle before endotracheal intubation can prevent sore throat. Ketamine is safe to use, has minimal side effects, well-tolerated, and available in the operating room. (Wei JL, 2012)

From the background explained above, the researchers wanted to know the comparison of the assessment of the patients' postoperative throat with general anesthesia on the use of lidocaine nebulizer and ketamine nebulizer at Haji Adam Malik Hospital Medan.

## II. RESEARCH METHODOLOGY

### A. The Scope Of Research

This study was carried out within the scope of anesthesiology.

### B. Research Design

The design of this study used a double-blind randomized clinical trial to determine the effectiveness of using lidocaine nebulizer and ketamine nebulizer in reducing sore throat in patients with general anesthesia.

### C. Place And Time

The study was conducted for 2 months, March - April 2019 in the elective surgery room of H. Adam Malik Hospital. The study was started after obtaining ethical clearance and permission from Haji Adam Malik Hospital.

### D. Research Population And Samples

The study population was all electively scheduled subjects underwent surgery using General Anesthesia in Haji Adam Malik Hospital Medan. The study sample was a population that fulfilled the inclusion and exclusion criteria. The samples were divided into 2 groups, they were:

- Group A received Lidocain nebulizer with a target for a lower sore throat.
- Group B received ketamine nebulizer with a target for a lower sore throat.

### E. Inclusion And Exclusion Criteria

#### ➤ Inclusion Criteria

- Aged 21-60 years old
- Patients with ASA physical status 1 and 2
- Patients agreed to participate in the study and signed the research inform consent
- Patients with an operating duration of <3 hours

#### ➤ Exclusion Criteria

- Patients with sore throat before surgery
- Patients with coughs and colds before surgery
- Surgery in the mouth, neck and face area

#### ➤ Drop out Criteria

- Heart and lung Emergency
- Difficulties in intubation occur (more than 2 attempts at intubation)
- An allergic reaction to lidocain and ketamine nebulizer occurs
- During surgery, ETT leaks out of position or is pulled out

#### ➤ Procedures

- Evaluation of patients based on inclusion and exclusion criteria..
- Randomized block sampling was carried out by volunteers and the sample was divided into two groups.
- Patients fasted for 6 hours before surgery and infusion with number 18 G intravenous cannula.
- The researchers taught the patients the correct deep breathing technique by showing it in front of the patients, with a frequency of 16-18x per minute. The nebulizer medicine ran out until it reached the oropharynx area (no smoke from the nebulizer).
- This research was assisted by two volunteers. The first volunteer prepared medicine and nebulizer equipment. The first volunteer gave the medicine prepared to the second volunteer. The second volunteer who did not know what drugs had been prepared then handed over the medication to patients who also did not know what drugs had been given.
- In the monitoring room, monitors for blood pressure, pulse, ECG and oxygen saturation were installed. The patients were asked to breathe in smoke/vapors from the nebulizer until the smoke from the nebulizer ran out. A 2.5 bar/250 Kpa compressor with air flow of 10 L/i were used  
Group A: Ketamin Nebulizer 50 mg, 1 ml diluted with nacl 0.9% to 5 ml.  
Group B: Lidocaine Nebulizer 100 mg (2% with 5 cc)  
After the nebulizer, the patients were monitored for 10 minutes
- The patients were taken to the operating room, and the monitors were installed again. The patients were lying on the operating table, given Midazolam 0.05 mg/kg BW, Fentanyl 2 ug/kg BW intravenously. Preoxygenated with O<sub>2</sub> 8 liters/minute was given through a facemask for 3 minutes. Induction with

- Propofol 2-3 mg/kg BW was carried out before Rocuronium 1 mg/kg BW was administered.
- The use of ETT was carried out 3 minutes after induction of anesthesia. Installation of ETT (maximum one time failure). Anesthesia was carried out by inhalation with breath control.
  - ETT number 7.5 ID for men and ETT number 7.0 ID for women. Tracheal intubation was carried out by the researchers and supervised by an anesthesiologist, who did not know the existence of each group.
  - ETT cuff was expanded to reach an internal pressure of 20 cm H<sub>2</sub>O. Intra cuff pressure was measured periodically with a cuff manometer every one hour and maintained with an intra-cuff pressure of 20 mm H<sub>2</sub>O
  - Inhalation of isofluran 0.8 - 1.5 vol% with a combination of N<sub>2</sub>O:O<sub>2</sub> = 50%: 50% and Rokuronium.
  - Ventilation was done by connecting the ETT connector to the semi-closed circuit.
  - End of surgery, neostigmine and atropine were given as antagonists of the neuromuscular block.
  - After the patients woke up and were fully conscious, ETT was removed after gentle suctioning from the ETT and mouth.
  - The airway was guarded and the patients were brought to the room for recovery and given oxygen through the nasal cannula 2 liters/minute without the help of the oropharynx tube.
  - Arriving at RR, the patients were given 30 mg / intravenous ketorolac analgesic.
  - Assessment of sore throat was carried out 4 times, first in RR 1 hour after the patients were conscious with the aldrete score 9-10, the second 6 hours after being conscious, the third 12 hours after being conscious, and the last, 24 hours after the patient was conscious, the assessor did not know what nebulizer drug had been given to the patients. Carefully observed and interviewed patients about sore throat using pain scale with values 0 to 10 then changed into loesser table.

**F. Data Analysis**

- The collected data were re-examined about the completeness before tabulated and processed and then analyzed by epi-info program and presented in the form of tables, sentences, and graphs.
- The collected data were tabulated into the master table using Microsoft Office Excel 2007 software.
- Numerical data were displayed in mean values ± standard deviation, while categorical data were displayed in numbers (percentages).
- The research hypothesis was tested using the Chi Square method using statistical software
- The significant limit was set to: 5%.

- The confidence interval used: 95% with a value of p < 0.05 considered statistically significant.
- The end of the study was a separate analysis of sore throat.

**III. RESEARCH RESULTS**

❖ *Results*

➤ *Sample Characteristics*

The study was conducted for 2 months, April - May 2019 at Haji Adam Malik Hospital in Medan. This study aimed to determine the comparison of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine. The samples obtained in this study were 48 samples that were in accordance with the inclusion and exclusion criteria. Sample characteristics are shown in Table 1.

Characteristic	Ketamin	Lidocaine
<b>Sex, n (%)</b>		
Male	12	13
Female	12	11
<b>Age, mean (SD)</b>	48,42 ± 13,7	51,25 ± 12,0
<b>BMI, mean (SD)</b>	21,3 ± 3,2	20,84 ± 5,6
<b>Duration of intubation</b>	148,5 ± 28,4	147,5 ± 38,4
<b>ASA</b>		
ASA 1	3	5
ASA 2	21	19
<b>Total</b>	<b>24</b>	<b>24</b>

Table 1:- Sample characteristics

Table 1 shows the distribution of sample characteristics in this study. It indicated that the characteristic data in this study were normally distributed, with p value > 0.05 on age and body mass index (BMI) characteristics, while the sex, duration of intubation and ASA characteristics data were not normally distributed with p value < 0.05. In addition, in this study, the samples were mostly male with 25 samples (52.1%) and a mean age of 49.83 years old. The mean body mass index (BMI) was 21.08 kg/m<sup>2</sup> which shows normoweight. The patients in this study were mostly in ASA 2 with 35 samples (32.7%).

• *Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T1*

Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T1 is shown in Table 2.

	VAS 1n (%)	VAS 2n (%)	VAS 3n (%)	VAS 4n (%)	Total	P value
Ketamin	5 (20,8)	16 (87,5)	3 (12,5)	0 (0)	24 (100)	0,001
Lidocaine	1 (4,2)	10 (41,7)	11 (45,8)	2 (8,3)	24 (100)	
<b>Total</b>	<b>6 (12,5)</b>	<b>26 (54,2)</b>	<b>14 (29,2)</b>	<b>2 (4,2%)</b>	<b>48 (100)</b>	

Table 2:- Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T1 (Independent T-Test, α<005)

Based on table 2, it was found that the VAS value of post-extubation throat pain in the group given ketamine the highest was VAS 2 with 16 patients (87.5%) whereas in the group given lidocaine the highest was VAS 3 (45.8%). In addition, in the ketamine group, there were no patients with sore throat with VAS 4, while in the lidocaine group there were 2 patients with VAS 4 (8.3%). Based on this, it can be concluded that patients given ketamine have lower VAS values compared to given lidocaine.

Statistically, there were significant differences in the value of post-extubation sore throat in the use of nebulized

	VAS 1n (%)	VAS 2n (%)	VAS 3n (%)	VAS 4n (%)	Total	P value
Ketamin	8 (33,3)	16 (66,7)	0 (0)	0 (0)	24 (100)	0,021
Lidocaine	5 (20,8)	11 (45,8)	7 (29,2)	1 (4,2)	24 (100)	
<b>Total</b>	<b>13 (27,1)</b>	<b>27 (56,3)</b>	<b>7 (14,5)</b>	<b>1 (2,1%)</b>	<b>48 (100)</b>	

Table 3:-Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T2 (Independent T-Test,  $\alpha < 0.05$ )

Based on table 3, it was found that patients who were given ketamine were not found to experience VAS 3 and VAS 4, but in the group given lidocaine there were still 7 people (29.2%) with VAS 3 and 1 person (4.2 %) with VAS 4. Besides that, in the ketamine group, there were more VAS 1 experienced, with 8 people (33.2%), compared to the 5 people (20.8%) in the lidocaine group.

Statistically, there were significant differences in the value of post-extubation sore throat in the use nebulized

lidocaine and ketamine in observation T1 with p value = 0.042(<0.05).

- *Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T2*

Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T2 is shown in Table 3.

lidocaine and ketamine in observation T2 with p value = 0,021(<0,05).

- *Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T3*

Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T3 is shown in Table 4.

	VAS 1n (%)	VAS 2n (%)	VAS 3n (%)	Total	P value
Ketamin	21 (87,5)	3 (12,5)	0 (0)	24 (100)	0,009
Lidocaine	13 (54,2)	8 (33,3)	3 (12,5)	24 (100)	
<b>Total</b>	<b>34 (70,8)</b>	<b>11 (22,9)</b>	<b>3 (6,3)</b>	<b>48 (100)</b>	

Table 4:- Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T3 (Independent T-Test,  $\alpha < 0.05$ )

Based on table 4, it was found that in patients given ketamine, there was not VAS 3, but in the group given lidocaine there were still those who experienced VAS 3 with 3 people (45.8%). Besides that, in the ketamine group, there were more VAS 1 experienced, with 21 people (20.8%), compared to the lidocaine group of 13 people (4.2%).

Statistically, there were significant differences in the value of post-extubation sore throat in the use of nebulized

lidocaine and ketamine in observation T3 with p value =0,009(<0,05).

- *Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T4*

Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T4 is shown in Table 5.

	VAS 1n (%)	VAS 2n (%)	VAS 3n (%)	Total	P value
Ketamin	22 (91,7)	2 (8,3)	0 (0)	24 (100)	0,033
Lidocaine	16 (66,7)	7 (29,2)	1 (4,1)	24 (100)	
<b>Total</b>	<b>38 (79,2)</b>	<b>9 (18,7)</b>	<b>1 (2,1)</b>	<b>48 (100)</b>	

Table 5:- Comparison of the value of post-extubation throat pain in patients with general anesthesia in the use of nebulized lidocaine and ketamine on T4  
Levene's Test,  $\alpha < 0.05$

Based on table 5, it was found that patients who were given ketamine were not found to have VAS 3, but in the group given lidocaine there were still those who experienced VAS 3 with 1 person (4.1%). In addition, the ketamine group experienced more VAS 1, with 22 people (91.7%), compared to the lidocaine group of 16 people (66.7%).

Statistically, there were significant differences in the value of post-extubation sore throat in the use of nebulized lidocaine and ketamine in observation T4 with  $p$  value = 0,033 (<0,05).

#### IV. DISCUSSION

This study was conducted to determine the comparative value of postoperative throat pain in patients with general anesthesia in the use of lidocaine nebulizer and ketamine nebulizer in Haji Adam Malik Hospital Medan and other network hospitals. Postoperative throat pain can be reduced by giving lidokan and ketamine.

In Table 1, it shows that the samples were mostly male with 25 samples (52.1%) and a mean age of 49.83 years old. The mean body mass index (BMI) was 21.08 kg/m<sup>2</sup> which shows normoweight. The patients in this study were mostly in ASA 2 with 35 samples (32.7%). The results of this study are consistent with the research conducted by Mehrotra *et al.* (2017) that the percentage of men was dominant in the study with a mean age of 38.93 years old and normoweight BMI index (Mehrotra *et al.*, 2017).

Based on table 2, it was found that patients given ketamine have lower VAS values compared to given lidocaine. Statistically, there were significant differences in the value of postoperative sore throat in the use of nebulized lidocaine and ketamine in observation T1. The results of this study are in line with the research conducted by Mehrotra *et al.* (2017) that ketamine can reduce throat pain in the early postoperative period and has a better long-term outcome compared to budesonide (Mehrotra *et al.*, 2017). The mechanism of the possible topical effect that weakens local inflammation causes a peripheral effect. Ketamine is an NMDA receptor antagonist with the main work location in the central nervous system and part of the limbic system (Zhu *et al.*, 2007). The observation period during the first hour (T1) showed that ketamine appeared to show a low VAS value compared to lidocaine. This is in accordance with several studies that also report that the incidence of sore throat occurs within 1 hour to 2 hours after endotracheal tube intubation (Biro *et al.*, 2005; Chen *et al.*, 2014; Higgins *et al.*, 2002).

Based on table 3, it was found that patients given ketamine were not found to have VAS 3 and VAS 4, but in the group given lidocaine there were still those who experienced VAS 3 and VAS 4. Statistically, there were significant differences in the value of postoperative sore

throat in the use of nebulized lidocaine and ketamine in observation T2. The results of this study are in line with the results obtained by Jain *et al.* (2017) that the effect of ketamine was found to significantly reduce sore throat at the 8th to the 12th hour (Jain *et al.*, 2017).

Another study also reported that patients given ketamine or lidocaine reported only mild pain with a POST score of 1 (mild) at 0 to 6 hours and no patients with a POST score of 2 (moderate) and POST score 3 (severe) (Dhanger *et al.*, 2018). Conway and Miler used sore throat as a syndrome that includes loss of voice, hoarseness, and stridor due to side effects of intubation. The other causes of hoarseness after intubation are submucosal bleeding, ulcers because of the length of contact with the cuff, subglottic edem, laryngitis and so on. The nasogastric tube can also cause hoarseness because of the possible interference with the posterior branch of the recurrent nerve of the larynx (Nolan and Wilson, 1992). The mechanism of the occurrence of sore throat after intubation according to Lee *et al.* (2017) is caused by high intracuff compression pressure resulting in tracheal mucosa, ischemic, ulcerative and painful hypoperfusion. This is caused by the intracuff pressure given around 20-30 cmH<sub>2</sub>O (Lee *et al.*, 2017).

Based on table 4, it was found that in the patients given ketamine, VAS 3 was not found, but in the group given lidocaine there were still those who experienced VAS 3 with 3 people (45.8%). Besides that, in the ketamine group, there were more VAS 1 experienced, with 21 people (20.8%) compared to the lidocaine group of 13 people (4.2%). Statistically, there were significant differences in the value of postoperative sore throat in the use of nebulized lidocaine and ketamine in observation T3. The results of the study are different from the research conducted by Tanaka *et al.* (2015) that in a meta-analysis study, from 19 studies with 1940 participants it was reported that lidocaine reduced the risk of postoperative sore throat with a risk ratio of 0.64 (Tanaka *et al.*, 2015).

Based on table 5, it was found that patients who were given ketamine were not found to have VAS 3, but in the group given lidocaine there was still 1 person (4.1%) who experienced VAS 3. In addition, the ketamine group experienced more VAS 1, with 22 people (91.7%), compared to the lidocaine group of 16 people (66.7%). Statistically, there were significant differences in the value of postoperative sore throat in the use of nebulized lidocaine and ketamine in observation T4. This is in accordance with the research that stated sore throat as a common side effect of general anesthesia and is reported to occur in between 30% and 70% of patients after intubation. The possibility of a sore throat can occur due to the endotracheal type, endotracheal diameter, and cuff pressure of the endotracheal tube used. Provision of prophylactic drugs can reduce postoperative sore throat. Many studies that recommended the use of local anesthetics and steroids to treat and prevent sore throat (Tanaka *et al.*, 2015).

## V. CONCLUSION

1. There is a significant difference in the value of postoperative sore throat in the patient with general anesthesia on the use of lidocaine nebulizer and ketamine nebulizer in observation of 1 hour (T1), 6 hours (T2), 12 hours (T3), 24 hours (T4)
2. In the postoperative sore throat in the patient with general anesthesia at 1 hour observation (T1), in the group given ketamine, the highest was VAS 2 with 16 patients (87.5%) whereas in the group given lidocaine the highest was VAS 3 (45.8%).
3. In the postoperative sore throat in the patient with general anesthesia at 6 hours observation (T2), the group given ketamine was not found to experience VAS 3 and VAS 4, but in the group given lidocaine there were still 7 people with VAS 3 (29.2%) and 1 person (4.2%) with VAS 4.
4. In the postoperative sore throat in the patient with general anesthesia at 12 hours observation (T3), the group given ketamine was not found to experience VAS 3, but in the group given lidocaine there were still 3 people experiencing VAS 3 (45.8%).
5. In the postoperative sore throat in the patient with general anesthesia at 24 hours observation (T4), the group given ketamine was not found to experience VAS 3, but in the group given lidocaine there were still 1 person (4.1%) with VAS 3.

## REFERENCES

- [1]. Ahmed A, Abbasi S, Ghafoor H, Ishaq M. Postoperative sore throat after elective surgical procedures. *J Ayub Med Coll Abbottabad*. 2017;19(2):12–4.
- [2]. Anderson R, Saiers JH, Abram S, et al Accuracy in equianalgesic dosing: conversion dilemmas. *J Pain Symptom Manage*. 2015;21:397-406.
- [3]. Anesthesia awareness. American Society of Anesthesiologists. When seconds count patient shome preparing for surgery risks anesthesia awareness. Accessed Sept. 28, 2015
- [4]. Anesthesiology: An overview. American Society of Anesthesiologists. When Seconds Count overview. Accessed Sept. 24, 2015
- [5]. Biro, P., Seifert, B., Pasch, T., 2005. Complaints of sore throat after tracheal intubation: a prospective evaluation. *Eur. J. Anaesthesiol*. 22, 307–11.
- [6]. Brunton LL, et al. General Anesthetics and Therapeutic Gases. In: Goodman & Gilman's the Pharmacological Basis of Therapeutics. 12th ed. New York, N.Y.: The McGraw-Hill Companies; 2011. <http://www.accessmedicine.com>. Accessed Sept. 24, 2015
- [7]. Cepeda MS, Tzortzopoulou A, Thackrey M, Hudcova J, Arora Gandhi P, Schumann R (2010). "Adjusting the pH of lidocaine for reducing pain on injection". *Cochrane Database Syst Rev*
- [8]. Chen, Y.-Q., Li, J.-P., Xiao, J., 2014. Prophylactic effectiveness of budesonide inhalation in reducing postoperative throat complaints. *Eur. Arch. Oto-Rhino-Laryngology* 271, 1667–1672.
- [9]. Chong, Nebulized Lidocain decreases incidence and severity of post-operative sore throat. 2015.
- [10]. Denny FW. Effect of treatment on streptococcal pharyngitis: is the issue really settled. *Pediatr Infect Dis*. 1985;4(4):352–4
- [11]. Dhanger, Vaidyanathan, B., Rajesh, I.J., Tripathy, D.K., 2018. Comparison of the efficacy of lignocaine viscous gargle versus ketamine gargle for the prevention of post-operative sore throat after classic laryngeal mask airway insertion: A prospective randomised trial. *Airway* 1, 13.
- [12]. Dorian RS. Anesthesia for the surgical patient. In: Schwartz's Principles of Surgery. 10th ed. New York, N.Y.: McGraw-Hill Education; 2015. Accessed Sept. 28, 2015
- [13]. European Society of Regional Anaesthesia and Pain Therapy (ESRA)., 2005. Post Operative Pain Management. ESRA. pp. 12-13.
- [14]. Falk SA, et al. Overview of anesthesia and anesthetic choices. <http://www.uptodate.com/home>. Accessed Sept. 24, 2015
- [15]. Hahn EO, Houser HB, Rammelkamp CH, Jr, Denny FW, Wannamaker LW. Effect of cortisone on acute streptococcal infections and post streptococcal complications. *J Clin Invest*. 1951;30(3):274–81
- [16]. Hamilton, Richart (2015). *Tarascon Pocket Pharmacopoeia 2015 Deluxe Lab-Coat Edition*. Jones & Bartlett Learning. p. 22
- [17]. Hayward G, Thompson M, Heneghan C, Perera R, Del Mar C, Glasziou P. Corticosteroids for pain relief in sore throat: systematic review and meta-analysis. *BMJ*. 2009;339:b2976. doi: 10.1136/bmj.b2976. Erratum in *BMJ* 2010;340
- [18]. Hayward, G; Thompson, MJ; Perera, R; Glasziou, PP; Del Mar, CB; Heneghan, CJ (Oct 17, 2012). Thompson, Matthew J, ed. "Corticosteroids as standalone or add-on treatment for sore throat". *Cochrane Database of Systematic Reviews*
- [19]. Hayward, Gail; Thompson, Matthew J; Perera, Rafael; Glasziou, Paul P; Del Mar, Chris B; Heneghan, Carl J (2012-10-17). *Cochrane Database of Systematic Reviews*. John Wiley & Sons,
- [20]. Hakim AJ, Grahame R, Norris P, Hopper C (February 2005). "Local anaesthetic failure in joint hypermobility syndrome". *J R Soc Med*. 98.
- [21]. Hirota K, Lambert DG. Ketamine: New uses for an old drug? *Br J Anaesth*. 2011;107:123–6.
- [22]. Hurley RW, Wu CL. Acute postoperative pain. In: Miller RD, editors. *Anesthesia 7<sup>th</sup>ed* : Churchill Livingstone, 2005: 2327-41.
- [23]. Higgins, P.P., Chung, F., Mezei, G., 2002. Postoperative sore throat after ambulatory surgery. *Br. J. Anaesth*. 88, 582–4.

- [24]. Jain, S., Bendwal, H.P., Gohiya, S., Alwani, N., Pancholi, S., Romday, R., 2017. Comparison of nebulized ketamine and ketamine with clonidine in postoperative sore throat. *Int. Surg. J.* 4, 1579.
- [25]. IASP., 2012. *Visceral Pain*. International Association for the Study of Pain. 2012: pp. 1-2.
- [26]. Jane, C. Ballantyne.,2008. *Acute Pain Management*. In: Longnecker D, Brwon D, Newman M, Zapol W. *Anesthesiology*. USA. The McGraw-Hill Companies. pp. 1743-63.
- [27]. Jackson D, Chen AH, Bennett CR (October 2014). "Identifying true lidocaine allergy". *J Am Dent Assoc.* 125 (10): 1362–6
- [28]. J. P. Nolan & P. J. F. Baskett. "Analgesia and anaesthesia". In David Skinner, Andrew Swain, Rodney Peyton & Colin Robertson. *Cambridge Textbook of Accident and Emergency Medicine*. Project co-ordinator, Fiona Whinster. Cambridge, UK: Cambridge University Press. p. 194
- [29]. Katzung BG, et al. *General Anesthetics*. In: *Basic & Clinical Pharmacology*. 12th ed. New York, N.Y.: The McGraw-Hill Companies; 2012. <http://www.accessmedicine.com>. Accessed Sept. 24, 2015
- [30]. Korb K, Scherer M, Chenot JF. Steroids as adjuvant therapy for acute pharyngitis in ambulatory patients: a systematic review. *Ann Fam Med.* 2010;8(1):58–63
- [31]. Larkin, R., 2009. *Acute pain management ; scientific evidence*. National Health and Medical Research Council. Commonwealth of Australia. pp.1-8.
- [32]. "Lidocaine Hydrochloride and 5% Dextrose Injection". *Safety Labeling Changes*. FDA Center for Drug Evaluation and Research (CDER). January 2014. Archived from the original on 2013-04-03
- [33]. "Lidocaine Viscous: Drug Safety Communication - Boxed Warning Required - Should Not Be Used to Treat Teething Pain". FDA Center for Drug Evaluation and Research (CDER). June 2014. Archived from the original on 2014-07-14.
- [34]. Lee, J.Y., Sim, W.S., Kim, E.S., Lee, S.M., Kim, D.K., Na, Y.R., Park, D., Park, H.J., 2017. Incidence and risk factors of postoperative sore throat after endotracheal intubation in Korean patients. *J. Int. Med. Res.* 45, 744–752.
- [35]. Mehrotra, D.S., Kumar, D.N., Khurana, D.G., Bist, D.S.S., 2017. Post Operative Sore Throat : Incidence after nebulization with Ketamine, Lidocaine and Budesonide. *Int. J. Med. Sci. Clin. Invent.* 4.
- [36]. Martí-Carvajal, AJ; Simancas-Racines, D; Anand, V; Bangdiwala, S (21 August 2015). "Prophylactic lidocaine for myocardial infarction". *The Cochrane Database of Systematic Reviews*. 8
- [37]. Moyse, DW; Kaye, AD; Diaz, JH; Qadri, MY; Lindsay, D; Pyati, S (March 2017). "Perioperative Ketamine Administration for Thoracotomy Pain". *Pain Physician.* 20 (3): 173–184
- [38]. Misiolek H, Cettler M, Woron J, et al. The 2014 Guidelines For Post-Operative Pain Management.
- [39]. Nolan, J.P., Wilson, M.E., 1992. An evaluation of the gum elastic bougie. Intubation times and incidence of sore throat. *Anaesthesia* 47, 878–81.
- [40]. Olowo-Okere, A., Ibrahim, Y.K.E., Sani, A.S., Atata, R.F., Olayinka, B.O., 2017. Prevalence of Surgical Site Infection in a Nigerian University Teaching Hospital. *J. Pharm. Allied Sci.* 14, 2430–8.
- [41]. Rose, J., Weiser, T.G., Hider, P., Wilson, L., Gruen, R.L., Bickler, S.W., 2015. Estimated need for surgery worldwide based on prevalence of diseases: a modelling strategy for the WHO Global Health Estimate. *Lancet. Glob. Heal.* 3 Suppl 2, S13-20.
- [42]. Sadeghirad, Behnam; Siemieniuk, Reed A C; Brignardello-Petersen, Romina; Papola, Davide; Lytvyn, Lyubov; Vandvik, Per Olav; Merglen, Arnaud; Guyatt, Gordon H; Agoritsas, Thomas (20 September 2017). "Corticosteroids for treatment of sore throat: systematic review and meta-analysis of randomised trials".
- [43]. Shaikh N, Leonard E, Martin JM (September 2010). "Prevalence of streptococcal pharyngitis and streptococcal carriage in children: a meta-analysis". *Pediatrics.* 126 (3): e557–64
- [44]. Spinks, Anneliese; Glasziou, Paul P.; Del Mar, Chris B. (2013-11-05), "Antibiotics for sore throat", *The Cochrane Library*, John Wiley & Sons, Ltd
- [45]. Tanaka Y, Nakayama T, Nishimori M, Sato Y, Furuya H. Lidocaine for preventing postoperative sore throat (review). *The Cochrane Library [Review]*. 2009;3(3) No.: CD004081. DOI: 10.1002/14651858.
- [46]. Thomas M, Del Mar C, Glasziou P (October 2017). "How effective are treatments other than antibiotics for acute sore throat?". *Br J Gen Pract.* 50 (459): 817–20
- [47]. Thompson, M; Vodicka, TA; Blair, PS; Buckley, DI; Heneghan, C; Hay, AD; TARGET Programme, Team (Dec 11, 2013). "Duration of symptoms of respiratory tract infections in children: systematic review". *BMJ (Clinical research ed.)*. 347
- [48]. Tanaka, Y., Nakayama, T., Nishimori, M., Tsujimura, Y., Kawaguchi, M., Sato, Y., 2015. Lidocaine for preventing postoperative sore throat. *Cochrane Database Syst. Rev.*
- [49]. Van Staa TP, Cooper C, Leufkens HG, Bishop N. Children and the risk of fractures caused by oral corticosteroids. *J Bone Miner Res.* 2014;18(5):913–8.
- [50]. Vanita A, Mitra S. Sarna R. Nebulized ketamine decreases incidence and severity of post-operative sore throat. 2015.
- [51]. Wiffen, PJ; Moore, RA; Quinlan, J (24 July 2014). "Topical lidocaine for neuropathic pain in adults". *The Cochrane Database of Systematic Reviews*. 7
- [52]. Zhu, Min, Zhou, Q., Zhu, Mei, Bo Rong, H., Xu, Y., Qian, Y., Fu, C., 2007. Effects of nebulized ketamine on allergen-induced airway hyperresponsiveness and inflammation in actively sensitized Brown-Norway rats. *J. Inflamm.* 4, 10.